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ABSTRACT

An interview taped in 1978 with Constance Kamii, a child development researcher who studied Piagetian theory at the University of Geneva, is presented in this document. When asked what teachers of young children should keep in mind, Dr. Kamii talked about teaching to the child's level and cautioned against dealing with symbolic materials, advising teachers to incorporate manipulable objects into curricula. Kamii suggests teachers can encourage children to make predictions about the outcomes of object manipulation and thereby learn essential relationships. The importance of teaching to a child's level of cognitive development is emphasized in an anecdote about the failure of an experimenter to teach children the concept of specific gravity. Kamii maintains this experimental failure was the result of teaching beyond children's capacity for understanding formal operations. Teaching cannot be accomplished directly, asserts Kamii; rather, people can be helped to learn when teachers start with knowledge already available to the learner. Kamii's forthcoming research projects are mentioned. (Author/DB)

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WHAT DO CHILDREN LEARN WHEN THEY MANIPULATE OBJECTS?

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an interview with

Constance Kamii
University of Illinois at Chicago Circle
University of Geneva

1978

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Thomas C. O'Brien: Hello. I am Tom O'Brien from the Teachers' Center Project at Southern Illinois University. Today we have a distinguished guest, Dr. Constance Kamii, who is from the University of Geneva and the University of Illinois at Chicago Circle. Our session will be very, very informal. It is an impromptu unplanned session. I think it will be interesting and fun.

Welcome to SIU. I would like to ask you a general sort of question at the start. (Dr. Kamii is a researcher, and she has done a great deal of curriculum research with teachers to find ways of fostering the growth of young children's thinking.) What are some basic principles that people who deal with young children -- teachers especially -- should keep in mind?

Constance Kamii: I think many teachers believe that it is important for young children to manipulate objects. That is, they believe that children learn not by dealing with symbolic materials, but by manipulating objects. But I think one of the things lacking in pedagogy is precision about <u>what</u>

children learn by manipulating objects and how they learn whatever they learn when they act on objects. Piaget is very helpful in enabling us to answer these questions. He makes a distinction between physical manipulation and logico-mathematical manipulation. For example, physical manipulation is where children get knowledge about physical properties of objects which are observable.

O'Brien: I touch a stove and I say it's hot.

Kamii: Yes. Or I kick a ball and it goes away. I kick it harder and it goes farther. All that is physical manipulation, action on objects. I prefer the term "action" to "manipulation" for reasons that will be clear shortly. The other kind of action is logico-mathematical. Children make piles of candy, M&M's of all colors, for example, and give some to you, some to me, some to you, and so forth. What they are doing here is to introduce an organization, or relationship, among objects, which has almost nothing to do with their physical properties. You can divide candy as well as pebbles and the physical properties are not important in this logico-mathematical action. Or you can make a pile of M&M's that are red, another pile of those that are yellow, etc. This is obviously sorting by color, which is another way of putting the objects into relationships. Children can also put the M&M's in linear order (with the first one, the second one, the third one, etc., all in one color) or some kind of pattern (red-yellow-red-yellow, for example). All these actions are of a logico-mathematical nature. In logico-mathematical actions, the subject introduces relationships among objects. In physical actions, by contrast, the subject finds out about objects and about properties and reactions that are observable in the external world. This is the basic theoretical distinction, but in reality what happens is that both kinds of manipulation take place at the same time. For example, when

children make block constructions, there is number, there is sorting when a child looks for cylindrical blocks, for example, and at the same time there is the physical knowledge of balance. In reality, both physical and logico-mathematical actions thus take place together. But I think it is important for the teachers to be able to analyze what is taking place.

O'Brien: And to distinguish between these two types?

Kamii: Yes.

O'Brien: I guess there are dangers there. The danger might be that the teacher might say that activity is important, so let's have activity just for activity's sake. I would suspect that that would be dangerous.

Kamii: Yes. Just any old manipulation that looks busy is not necessarily a sign that thinking is taking place.

O'Brien: So you would be interested in the child's bringing these physical objects into some sort of relationship?

Kamii: Yes. For example, the child may mindlessly mess around with marbles, or he may play an aiming game trying to knock some marbles out of an enclosure from a certain distance. There is a world of difference between mindless manipulation and manipulation that involves thinking. This is why I prefer the term "action" to "manipulation". Piaget says that a clear line of demarcation cannot be drawn between physical action and mental action. When a child bunches his marbles together, takes aim, and shoots one with a certain amount of force, for example, he thinks as a physicist. When he counts his marbles by moving them one by one and separating those that have been counted from those that still have to be counted, he is thinking numerically (logico-mathematically) about the same objects. It is thus not manipulation as such that is important but the thinking that goes with this manipulation that makes manipulation indispensable for children's intellectual development. The

thought of young children works with their physical actions and their thinking cannot be dissociated from these physical actions.

Another principle I would like to mention is the importance of not talking too much. I think teachers tend to talk too much, not only in early childhood education, but also later on. Very often we interfere with children's thinking by asking, "Is that big or is that little?" or "What do you call this?" and very often things which are of interest to the teacher are absolutely of no interest to the child. So along with the importance of manipulation, I would like to mention the unimportance of talking. These are two basic principles in early childhood education.

O'Brien: Let me put in a little commercial. There is a new book out -- I have had it on order but I've not been able to get it -- called Physical Knowledge in Preschool Education: Implications of Piaget's Theory, *published by Prentice-Hall in 1978.*

Kamii: There I elaborate on the idea of action and say that there are different ways in which children act physically on objects to get scientific knowledge. One is acting on the object and finding out how the object reacts. (The baby just pokes things and tries to tear things and so forth and finds out what happens when he acts on the object.) Another way is acting on an object in order to produce a desired effect. That is, the intention is already in the child's mind. In physical-knowledge activities, that distinction is useful because very often children will do more thinking if there is some effect that they are interested in producing -- something to knock down, something to build up, and so forth.

O'Brien: So prediction is involved.

Kamii: Yes, and "making a prediction" is another way of saying "putting things into relationships."

O'Brien: It involves thinking about the consequences of one's actions, not simply observing the consequences of one's action. The thinking takes place in advance of one's action.

Kamii: Yes. I have some slides that show children playing with a pendulum. Kids will play with a pendulum and tell each other, "You stand there and catch it," and they will play for a long time, but there comes a point where they are no longer challenged by throwing the pendulum around. A teacher can introduce a doll or some other object that stands and say to the child, "Now where do you need to stand (holding the pendulum bob) to knock this object down?" That kind of problem interests children. Knocking things down gives them an interesting effect to think about. Usually, they will try from one place, and then if they miss the target, they will correct themselves. Then they might miss it again, and correct again so that a progressive approximation and a structuring takes place. For example, if it goes too far to the right the first time and they correct this and the pendulum goes too far to the left the second time, they structure the previous knowledge and correct it when they try the third time. In that process is certainly seriation. This kind of seriation in action (as children think about "too far to the right," "not far enough," etc.) is a much better way to construct relationships than any exercise on paper that you can think about.

The activity can be varied. At the level of four- and five-year-old children it is fun enough to knock things down. Then comes a point where they become bored with this activity. You can then introduce other interesting problems. For example, you can use a bunch of IBM printout rollers or long blocks and say to the kids, "Okay, everybody take ten and put them on the floor to knock down as many as you can." The children will try all kinds of things. Sometimes they will space them apart. Sometimes they will

try different arrangements. Then another challenge -- it is interesting to see this -- is to keep score. The teacher's intervention just at the right time is important. Sometimes the teacher will say, "Okay, maybe you want to keep score. Here is paper and pencil." Some kids will say, "Okay, your name is Larry. If you knock down 4, then put 4 L's down." So they keep score this way. It is very interesting to see scorekeeping methods children use. At the beginning the L's are all over the place, or they don't correspond to the number knocked down. But in first grade the scores (such as 4 L's) become linearly arranged. When this happens, children are using a spatial order to represent a temporal order for each player.

I think I am slipping into making another point, and that is the importance of teaching many things in one activity instead of teaching one thing with one activity and trying to teach something else with another activity. In other words, in this physical-knowledge activity is not only science, but also logic, arithmetic, and the construction of spatial and temporal relationships.

O'Brien: And representation?

Kamii: And representation of numerical notions and a sequence of events organized in a way that is useful to play a game.

O'Brien: Let me go back now. You are saying that with a free-swinging pendulum, the task might be, "Here are ten of these blocks. Arrange them so that you can knock down as many as possible."

Kamii: Yes.

O'Brien: It's a lovely problem. It might seem to the teacher that this is a mere fun or idle sort of kill-time activity. You are saying that it is much more than that.

Kamii: Oh, yes, it is much more than that. Some children count the

number of blocks knocked down, while others count the number still standing up. Subtraction is obviously involved here. Another thing I would like to emphasize is the social and moral development of the child involved in these actitities. I think that this is an important part of Piaget's theory that is often overlooked. He insists that children's social interactions are absolutely essential for their moral development as well as for the development of their logic. In playing with a pendulum, children regulate the game themselves. They say, "It is your turn, my turn, etc." "This is not the way you keep score. I want to keep it this way." "No, that is not the way you write it," and so forth. All those arguments are extremely important because it is in this kind of give and take that children work out rules for themselves and construct their own rules about what is right to do. Moral development simply does not take place by stuffing kids with rules or values. I think that this is an important and basic difference between empiricist teaching and a Piagetian approach. According to Piaget, neither moral values nor knowledge is learned by <u>internalization</u> from the outside. Right now I am doing research with card games in an inner-city first grade classroom with the slowest group of first graders. One of the things I am finding out, for example, involves children playing War with cards. The children do have cognitive problems. They <u>can</u> play War in some way at their own level. But what is lacking, which is more serious, is their social development. I feel that they cannot keep themselves organized enough to keep a game going to the extent of being able to benefit from the game. So far I have been doing this research with me present and when one child cheats, for example, the other child looks to me to take care of the cheating. And if I say, "Are you going to let him cheat you like that? Why don't you say something?" the child

still looks to me. So the card game certainly has a lot of cognitive potential, but if the kids are not able to govern themselves socially, they forever depend upon the teacher to play this game. It is the same thing with the pendulum activity. You need a certain level of social development -- being able to take turns and get along together to keep a game going. This is one of the hardest things to work on, especially in inner-city schools, I find.

O'Brien: What is the chemistry? I can see one child playing with a pendulum for hours on end trying to find out how to swing it or how to arrange the things that are going to get hit. What is the chemistry of the group situation? What advice is there for teachers to help kids with their social interactions to keep an issue sustained over a period of time?

Kamii: Well, I think the most important principle of teaching here is to help children to work out their own conflicts. To the extent that it is possible, do not suggest a solution and try, instead, to encourage negotiations among children so that they will become able to contruct their own solution autonomously. Do not impose yourself and certainly do not solve problems for them. At the beginning the teacher might have to say, "Do you think such and such would be a good idea?" "Do you think that is acceptable?" "What do you think we should do?" The teachers should ask for the children's opinion as much as possible. Sometimes the discussion about, "Do you think that it is fair?" "Do you think that is right?" takes so long that kids don't play cards or don't play with the pendulum, but I think it is worthwhile investment and an important educational event in itself to learn to argue constructively to negotiate an agreement.

O'Brien: The goal is that the child ultimately becomes self-regulating rather than being regulated by the teacher.

Kamii: Yes. And again we see the importance of action here. Children act on each other, get other people's reactions, and think as they interact with other people. If they did not act, they would not have any occasion to think about fairness or justice, and this is one of the reasons why it is important for children to talk to each other in class. Moral development does not take place by being obedient and conditioned into "internalizing" the "right" habits. Empiricists think that moral education is a question only of producing the "right" moral behavior.

O'Brien: You did some research some time ago on intellectual development where you contrasted an empiricist's point of view with the Piaget-oriented point of view. Do you want to comment on that? What did your research have to show?

Kamii: Are you referring to my experiment with Engelmann?

O'Brien: Published in 1971, I think.

Kamii: Yes, that was an interesting experiment because Mr. Engelmann said in essence that if a kid doesn't know something, it is because he has not been told that something. So he personally taught specific gravity to some six-year-olds. My position was that you couldn't teach specific gravity before children achieved formal operations. He let me give the post-test and did not contest the facts at all. He did agree that the kids did not learn specific gravity. But he and I had completely different interpretations of these facts. He said if he had had enough time to perfect the program he could have brought the children up to criterion. My position was no, you can't possibly teach that stuff. It is very interesting that

he has not followed up on that experiment. It has been ten years since we confronted each other in February 1969, at that conference at the California Test Bureau.

O'Brien: The task was to predict whether something would float or sink and to explain why it would float or sink. Am I on the right track?

Kamii: Predicting whether or not something will float is physical knowledge and we were not interested in that. It is the logic involved that was the focus. For example, the kids had pieces of soap. Some were small pieces and some were the regular size. Then these kids, after being taught by Engelmann, would put one little piece in the pile of things that would sink and an identical piece in the pile of things that would float. Logically that was nonsense, and it was this kind of logical or illogical thinking that was the point of the experiment as far as I understood from Chapter 2 of The Growth of Logical Thinking from Childhood to Adolescence (by Inhelder and Piaget). One of the interesting things we did was to use a big hunk of Ivory soap which floated and a little hunk of soap which sank. Kids have to think logically to explain these phenomena. We put the two pieces of soap in the child's hands and asked, "Which one is heavier?" Of course, the child said that the big hunk was heavier. And we asked, "Which do you think will float?" Young children have a tendency to say that little things will float because they are light and big things will sink because they are heavy. And that is the kind of thing that the children said. However, when we put the objects in water and one child saw that the big, heavy piece of soap floated and the light one sank, she ended up saying, "Well, this (big) one must be lighter than this (small) one," because she had been taught the rule that if something floats it is because it is lighter

than 'a piece of water' the same size," and if something sinks, it sinks "because it is heavier than 'a piece of water' the same size." So they just took parts of the rule and tried to make sense out of what they saw and ended up saying that "This (big) one must be lighter."

That experiment proved not only that you could not teach things that are impossible to teach before a certain level, but also that those teaching methods can mess up thinking that children are otherwise perfectly capable of. I think it is unethical to mess up that much.

O'Brien: The people who would be watching this should know about Stanley Erlwanger's research (Ph.D. dissertation, University of Illinois) on the effects of IPI mathematics instruction. A real messing up occurred with those kids.

I have a block-buster of a question. Can you teach, can one teach, can a person teach, another person?

Kamii: Can one person teach another person? I don't think you can teach directly anything. But on the other hand some teachers are better than others, which suggests to me that better teachers are the ones who help the learner construct knowledge better by starting with things that the learner already knows.

O'Brien: So you are not very encouraging about transmitting one person's organization to another person. I've got this organized complex of ideas and I'm going to transmit it to you. Your impression is that that is not going to work.

Kamii: That's not durable, although you can get the illusion that that is what you are doing. In education it is very funny because when a teacher succeeds in teaching something, he thinks it is his teaching that did it. But if he does not succeed in teaching the same thing, we often hear that it

is the child who is not "mature" or "ready". If the child explains the not-learning, then the child needs to explain the success of the teaching.

O'Brien: What things would you suggest that people be reading if they wanted to engage a constructivist point of view or if they wanted to extend their constructivist point of view?

Let me put you on the spot, what things have you yourself done that you think people might not know about? Let's mention that to people. The new book, Physical Knowledge. What other things have you done that we can tell people about?

Kamii: I hope to finish a book on group games for children. That will be ready very soon. The next book that I plan to do after that is on the use of card games for the teaching of arithmetic. For now, all I can think of is Piaget, Children, and Number (by Kamii and DeVries, Washington, DC: National Association for the Education of Young Children, 1976), "Piaget for Early Education" (by Kamii and DeVries, in The Preschool in Action (2nd ed.), M.C. Day and R.K. Parker (eds.), Boston: Allyn & Bacon, 1977), and "Piaget's Theory, Behaviorism, and Other Theories in Education" (by Kamii, in the Journal of Education, Vol. 161, No. 1, Winter 1979). I would like to point out the difference between reflective abstraction and empirical abstraction that I discuss in Piaget, Children, and Number. Piaget makes it clear that abstraction is one thing, and representation is quite another thing. Educators generally do not make this distinction, and I think this is one of the reasons why they reach pencil-pushing arithmetic in first grade dealing with symbolic materials when the underlying reflective abstraction is not yet there for kids to think about "4 + 2 = __" or "4 + __ = 6." I would like to do research to prove that pencil pushing (representation) becomes easy if the first grade teacher works on reflective

abstraction with objects under manipulation for a long time.

O'Brien: How about old stuff that people could run across that they might not know about? The research on floating and sinking, where would that be found?

Kamii: That is hidden in a book called Measurement and Piaget, McGraw-Hill 1971, edited by Donald R. Green, Marguerite P. Ford, and George B. Flamer.

O'Brien: What other things should people be reading? A teacher comes up to you and says, "I want to grow, I want to stretch myself a little bit." What should teachers be reading?

Kamii: That depends on who the teacher is, but, for example, do you recommend Piaget's own books?

O'Brien: Usually I don't as a start. I think that they are must reading, but I don't suggest someone start with original Piaget.

Kamii: That is true.

O'Brien: What introductory books?

Kamii: What books to recommend on Piaget to beginners? That's a hard one. I myself have not found a good one that I can recommend.

O'Brien: So what Piaget books make the best beginning reading if one were to start reading Piaget's own writings?

Kamii: I think there is a big difference between Piaget when he speaks and Piaget when he writes. His writing is bad, just plain bad. What I would suggest is transcriptions of what he has said.

O'Brien: Connie can easily say this because she is bi-lingual, tri-lingual.

Kamii: I had read Piaget's brilliant but incomprehensible books, and then when I went to Piaget's last lecture in 1965, I was absolutely amazed that he could talk clearly and simply so that everything was crystal clear.

Piaget Rediscovered I think that is good and clearly written. Part of The Psychology of Intelligence is also spoken Piaget transcribed. Aside from that, I recommend The Moral Judgment of the Child. I think it absolutely essential for teachers to understand the difference between the morality of autonomy and the morality of obedience.

O'Brien: Thanks to Constance Kamii for joining us and for sharing some of her ideas. I suggest that if one were interested, one might get hold of the 1971 McGraw-Hill book with the floating and sinking research and also the new book, Physical Knowledge.